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Acculturation and Dental Caries among Children in Spain

ABSTRACT

Background: This study explored the relationship between different indicators of acculturation and children's caries experience.

Methods: Data from 313 children attending the Dental Clinic of the European University of Madrid were analysed. Acculturation was measured via generational status, age at arrival, length of residence and language spoken at home. The association between each indicator of acculturation and caries experience was assessed in Poisson regression models adjusting for confounders.

Results: First- and second-generation migrant children had greater caries experience than Spanish-born children. These differences only persisted for first-generation migrant children after adjustment for confounders. Children who arrived in Spain before age 6 years, who lived in Spain for 10 or more years and who spoke a language other than Spanish at home had greater caries experience than Spanish-born children.

Conclusion: Inequalities in caries experience between migrant and native children were evident (favouring the local children) and independent of family's socioeconomic circumstances.

Keywords: migration, acculturation, dental caries, children, public health dentistry

INTRODUCTION

In the last five decades, the population of the most developed world regions has become more and more heterogeneous, mainly due to a considerable increase of the migrant population [1, 2]. Upon arrival in a new society, migrants are exposed to a new culture and are subject to a process of acculturation [3]. The term acculturation refers to the cultural changes that occur when two populations come into continuous first-hand contact, and it has been treated in two ways in previous literature: as a unidimensional measure of the adoption of values, beliefs, norms and behaviours of another population, or as a bi-dimensional measure of adherence to each of two cultures [4, 5]. Children in migrant families often demonstrate better-than-expected health, suggesting that cultural health-related practices among migrant families might be protective in some areas of health [2, 6, 7].

A number of studies have shown greater caries experience in migrant than native children [8-11], even after accounting for family's socioeconomic circumstances [12, 13]. What is missing in the literature is studies exploring what factors could explain such oral health differences. A recent review of the impact of acculturation on oral health identified 8 studies in children [14]. Although most studies found that acculturated children had better dental status, results varied depending on the indicator of acculturation used (even within the same study) and whether differences were adjusted for confounders. The authors found conflicting results for mother's length of residence and language proficiency. On the other hand, children's place of birth (native-born), use of local language and length of residence were positively related to their oral health (caries experience and parental reports) while parental and child age at migration were negatively related with children's caries experience [14].

In Spain, inequalities in oral health between migrant and native groups have just started to be explored. A study in Valencia showed that migrant adolescents (non-Spanish nationals whose parents were foreign-born and who had been living in Spain for less than 4 years) were more likely to have dental caries than Spanish children after adjustment for age, social class and intake of cariogenic foods [15]. The 2010 national oral health survey found greater caries experience in foreign-born than Spanish-born children. These differences persisted in the primary dentition, but not in the permanent dentition, after controlling for socio-demographic factors. Furthermore, foreign-born children had more teeth with untreated decay but fewer fillings than Spanish-born children [16]. The 2015 national oral health survey also found greater caries experience in foreign-born than Spanish-born children. However, differences were significant for 5-6- and 15-year-olds but not for 12-year-olds [17]. Similar

results were reported in a population-based survey of the Autonomous Community of Madrid in 2016 as Spanish-born children had lower caries experience than foreign-born children aged 6, 12 and 15 years, although these differences were only significant among the oldest group [18]. It is important to know how the acculturative process affects child health to reduce health disparities and inform public health action. To fill this gap in knowledge, a study was set out to explore whether different indicators of acculturation were associated with caries experience in children of Madrid, Spain.

METHODS

Participants

This cross-sectional study was based on a convenience sample of patients. A total of 333 children were recruited from those attending the Dental Clinic of the European University of Madrid (Spain) between February 2014 and July 2015. All parents of children between 6 and 17 years of age were invited to participate. A minimum sample size of 126 children (63 Spain-born and 63 migrants) was required to estimate a mean difference in the number of decayed, missing and filed teeth greater than 0.5 units between groups, based on data from the 2015 survey [17], with 80% statistical power, 95% confidence level and assuming unknown but equal variance across groups.

The study was approved by the Health Sciences Research Committee of the European University of Madrid (CIPI/028/13). Written informed consent was obtained from parents before participation.

Data collection

Data were collected from supervised questionnaires and clinical records. The questionnaire collected information on children's demographic background and migration status as well as on parents' demographic factors, socioeconomic characteristics and migration status.

Acculturation was measured using four proxy measures: generational status, age at arrival (before age 6 years versus at age 6 years or older), length of residence in Spain (less than 10 years versus 10 or more years) and language spoken at home (Spanish only, Spanish and other language, and other language only). Generational status was defined based on children's own nativity and that of their parents. It consisted of three categories: foreign-born children with both migrant parents (first generation), Spain-born children with one or both migrant parents (second generation), and Spain-born children with both Spanish-born parents. The first two groups together make up the overall

migrant category consisting of children born to one or both migrant parents, whereas the third category consists of native-born children (henceforth Spanish-born) [7, 19, 20].

Covariates included were child (sex and age) and family factors (social class, marital status and maternal education). Family socioeconomic position was determined by social class based on the head of household's occupation following the Spanish Society of Epidemiology classification [21] that grouped individuals with similar levels of occupational skill using an ordinal scale with five main categories: higher-level professionals, senior technical staff, managers of large companies (I); intermediate-level professionals and managers of small companies (II); administrative workers, clerks, safety and security workers and self-employed workers (III); skilled and semi-skilled manual occupations (IV); and unskilled manual occupations (V). These classes were collapsed into managerial (I-II), skilled and semi-skilled worker (III-IV) and unskilled worker (V) for analysis [22, 23]. Marital status was classified as cohabiting (married and partnered) and not cohabiting (never married, separated, divorced and widowed). Maternal education was defined according to the highest educational level achieved (university, college, secondary school, and primary school or less).

Data on children's caries experience were extracted from dental records. Dental caries was diagnosed at the cavity into dentine threshold following the Dental Clinic examination protocol. The number of deciduous and permanent teeth as well as the number of decayed and filled deciduous teeth (dft index) and the number of decayed, missing and filled permanent teeth (DMFT index) were extracted from the dental records, depending on the age of the child. The sum of the two indices (dft + DMFT) for each participant was the outcome measure for analysis.

Statistical analysis

All analyses were carried out in IBM® SPSS® Statistics version 22 for Windows (IBM Corporation, Armonk, NY, USA). Poisson regression was used for modelling children's caries experience as the latter was a count variable. Rate ratios (RR) were therefore reported. The sum of deciduous and permanent teeth (in its continuous form) was used as the offset variable in regression models.

The modelling strategy was first to estimate the crude association between each indicator of acculturation and children's caries experience, and then, gradually adjust for confounders of the association. Hence, the crude association of generational status with caries experience was first estimated (labelled as Model 1). This association was then sequentially adjusted for child factors (sex

and age) in Model 2 and additionally for family factors (social class, marital status and maternal education) in Model 3. We repeated the modelling strategy with age at arrival, length of residence in Spain and language spoken at home in separate set of regression models. When reporting estimates from regression models, Spanish-born children were the reference category for comparison. We run two sets of sensitivity analysis. In the first set, we repeated the set of regression models for each dentition separately. That is, using the number of deciduous and permanent teeth with caries experience as separate outcomes. In second set, we repeated the set of regression models using the number of decayed teeth rather than caries experience as the outcome measure.

RESULTS

This study used data from 313 children who agreed to participate and had complete data on relevant variables (94% of the full sample). The migrant group was mainly represented by Moroccans (32%), Ecuadorians (26%) and Eastern European (17%). Table 1 shows the composition of the study sample by generational status. First-generation migrant children were older than Spanish-born and second-generation migrant children. In addition, migrant children had mothers with higher levels of education but lived in lower social class than their Spanish-born counterparts.

There were, on average, 7.3 teeth with caries experience per child (Standard Deviation: 4.4, range: 0 to 22). Only 7.7% of children were caries-free and the d/D component represented 83.3% of the caries experience. Table 2 shows variations in children's caries experience by indicators or acculturation and covariates. Caries experience was the highest among first generation children (dft+DMFT=8.2), those who arrived in Spain before 6 years of age (9.1), those with 10 or more years living in Spain (9.6), and those speaking other language than Spanish at home (8.8). In addition, male children (7.8), the oldest (8.9), those living in the lowest social class (8.4) and children whose mothers had the lowest education (8.4) showed the greatest caries experience. No differences were found by marital status.

Generational status was significantly associated with children's caries experience (Table 3). First- and second-generation migrant children had, respectively, 15% (95%CI: 3-28%) and 19% (9-31%) greater caries experience than Spanish-born children. These differences remained significant after adjusting for child factors (sex and age) in Model 2. However, they were no longer significant for second-generation migrant children after further adjustment for family factors (social class, marital status and

maternal education) in Model 3. Only first-generation migrant children were significantly different from Spanish-born children, having 18% (5-33%) greater caries experience. When first- and second-generation migrant children were combined in a single group, they had 13% (4-24%) greater caries experience than Spanish-born children, after controlling for child and family factors.

Table 4 shows the results for the association of other indicators of acculturation with children's caries experience. By age at arrival, first-generation migrant children arriving in Spain before 6 years of age had 34% (17-53%) greater caries experience than Spanish-born children. By length of residence, first-generation migrant children with 10 or more years in Spain had 38% (18-61%) greater caries experience than Spanish-born children. By language spoken at home, children in families speaking Spanish and other language and children in families speaking other language only had, respectively, 31% (14-50%) and 25% (9-83%) greater caries experience than those in Spanish-speaking families. Similar results were found when modelling dental caries experience in deciduous and permanent teeth separately (Tables S1 and S2, respectively) and when replacing caries experience with the number of decayed teeth (untreated disease) as the outcome measure (Table S3).

DISCUSSION

This study provides some support for the role of acculturation in explaining inequalities in child oral health. Inequalities in dental caries between migrant and native children were evident (favouring the local children) and independent of family's socioeconomic circumstances. We also found evidence of greater caries experience among specific groups of migrant children. More specifically, first-generation migrant, those who arrived in Spain at an early age, who have been living in Spain for a longer time and who spoke a language other than Spanish had more teeth with caries experience.

Some limitations of this study need to be borne in mind when interpreting the present results. First, this study is based on cross-sectional data, and thus, we are only able to test for associations not causal relationships. Although our findings suggest that acculturation may play a role in the oral health of migrant children, they should be confirmed with longitudinal data. Second, this study was based on a convenience sample of a single Dental Clinic in Madrid, and thus, it does not represent the entire population of migrant children in Spain. What is more, recruitment from a Dental Clinic implies that participants had access to, and sought out, dental care. These children might have caries experience different from those that do not have access to dental services. Therefore, the present

findings cannot be extrapolated beyond the study sample. Third, although our sample size was large enough to test the hypothesised relationships, it did not allow for further stratification by country of origin or nationality. This is an area that requires further investigation. Fourth, we measured acculturation with proxy measures despite recent criticism about their usefulness because they do not directly measure elements of acculturative change [4]. However, these measures are commonly used in research on acculturation, particularly in new settings where validated instruments are not available [5, 24]. In addition, we used four different proxies to cover different aspects of the acculturative process. Finally, no attempt to control for dental behaviours was carried out. As our aim was to assess the overall impact of acculturation on childhood caries experience, it was considered inappropriate to adjust for dental behaviours. Indeed, dental behaviours are considered as merely intermediates of the relationship between the broader social determinants and oral health [25-27].

Migrant children exhibited greater caries experience than Spanish-born children. This finding agrees with previous studies in Spain [16-18] despite methodological differences among studies such as the definition of migrant (children born abroad, without including children of migrant families born in Spain) and lack of adjustment for social conditions [17, 18]. Our definition for migrant children was consistent with current frameworks [6, 20, 28] and recent international evidence [7, 19].

We also found that caries experience and untreated caries (Table S3) were higher among certain groups of migrants. Children who use another language at home (either alone or in combination with Spanish) had greater caries experience and untreated caries than Spanish-born children and migrant children who only speak Spanish at home. Language proficiency gives migrant families greater availability of health-related information while also reducing barriers to accessing and interacting with health care and social services [2, 6, 29]. However, in Madrid, differences in restoration indexes have not been found for permanent dentition [18]. Probably, because the healthcare system in Madrid (and the rest of Spain for that matter) provides free preventive and restorative care for the permanent teeth of children. Language spoken also reflects country of origin, and as such, epidemiological differences in caries profile between world regions [30]; most migrants from South America will speak Spanish as opposed to those coming from Eastern Europe (mainly Romanians) and North Africa (mainly Moroccans).

Our findings for age at arrival and length of residence were quite consistent with each other, although not necessarily in line with those found in previous studies [31-33]. Children who arrived before age 6

years and those who have spent 10 or more years in Spain had greater caries experience and untreated caries than Spanish-born and second-generation migrants. These findings suggest that the process of children's acculturation in Spain is not associated with better oral health, at least not at first. Changes in eating habits after arrival can have repercussions on children's oral health, possibly due to greater exposure to cheap food high in sugar [10]. However, once migrant families are settled in Spain (by acquiring language proficiency and job opportunities) they could enjoy greater food choices and healthier dietary patterns which will be reflected on their children's oral health (second generation).

The present findings have some implications for policy and research. In Spain, most public health policies have been traditionally based on equal rights to healthcare for all, regardless of immigration status. In Madrid, several public health programmes (such as immunisations, maternal and child health promotion and communicable diseases prevention) specifically target the migrant population. It would be advisable to include children's oral health in that list, particularly those described above. As for research, further studies should analyse the influence of acculturation in children's oral health, specifically looking at factors underlying such association such as health behaviours. The use of valid multi-dimensional instruments may also help exploring other aspects of the acculturative process.

In conclusion, this study shows the existence of clear inequalities in dental caries between migrant and native children which were not fully accounted for by their families' socioeconomic conditions. Other factors may therefore play a role in explaining these inequalities. Children who arrived in Spain at an early age, who have been living in Spain for a longer time and who spoke a language other than Spanish exhibited greater caries experience.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest in relation to this study.

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Table 1. Characteristics of the sample by generational status (n=313)

Explanatory variables	Spanish-born (n=136)		2nd generation (n=110)		1st generation (n=67)		p value[a]
Sex, n (%)							0.6
Male	66	48.5%	48	43.6%	34	50.7%	
Female	70	51.5%	62	56.4%	33	49.3%	
Age in years, Mean (SD)	10.9	(3.2)	9.2	(2.5)	13.7	(2.7)	<0.001
Social class, n (%)							0.001
V (Lowest)	37	27.2%	47	42.7%	30	44.8%	
III-IV	70	51.5%	58	52.7%	30	44.8%	
I-II (Highest)	29	21.3%	5	4.5%	7	10.4%	
Marital status, n (%)							0.4
Cohabiting	107	78.7%	85	77.3%	47	70.1%	
Not cohabiting	29	21.3%	25	22.7%	20	29.9%	
Mother's education, n (%)							0.007
Primary	26	19.1%	22	20%	15	22.4%	
Secondary	42	30.9%	30	27.3%	7	10.4%	
College	36	26.5%	40	36.4%	34	50.7%	
University	32	23.5%	18	16.4%	11	16.4%	
Language spoken at home, n (%)							0.2
Spanish only			64	58.2%	47	70.1%	
Spanish and other language			24	21.8%	9	13.4%	
Other language only			22	20%	11	16.4%	
Age at arrival, n (%)							N/A
Before age 6 years					39	58.2%	
At age 6 years or older					28	41.8%	
Length of residence in Spain, n (%)							N/A
Less than 10 years					40	59.7%	
10 years or more					27	40.3%	

[a] Chi-squared test was used for comparisons
N/A: not applicable

Table 2. Dental caries experience (dft+DMFT) of 313 children in Madrid, by child and family factors and indicators of acculturation

Explanatory variables	Mean	[95% CI]	p value[b]
Sex			0.06
Boys	7.8	[7.1-8.5]	
Girls	6.8	[6.2-7.5]	
Age groups[a]			0.004
6-10 years	7.0	[6.5-7.6]	
11-14 years	6.6	[5.6-7.6]	
15-17 years	8.9	[7.6-10.3]	
Social class			<0.001
Class I-II (Highest)	4.1	[3.0-5.2]	
Class III-IV	7.3	[6.6-8.0]	
Class V (Lowest)	8.4	[7.6-9.2]	
Marital status			0.66
Cohabiting	7.3	[6.8-7.9]	
Not cohabiting	7.1	[6.2-8.0]	
Maternal education			<0.001
University	5.1	[4.2-6.1]	
College	7.0	[6.1-7.8]	
Secondary	8.4	[7.4-9.4]	
Primary or less	8.4	[7.4-9.5]	
Generational status			0.04
Spain-born	6.6	[5.9-7.4]	
2nd generation	7.5	[6.7-8.3]	
1st generation	8.2	[7.1-9.3]	
Length of residence in Spain			0.02
Spanish-born	6.6	[5.9-7.4]	
2nd generation	7.5	[6.7-8.3]	
1st generation <10 years stay	7.3	[6.0-8.6]	
1st generation 10+ years stay	9.6	[7.7-11.4]	
Age at arrival			0.02
Spanish-born	6.6	[5.9-7.4]	
2nd generation	7.5	[6.7-8.3]	
Before age 6 years	9.1	[7.7-10.5]	
At age 6 years or older	7.0	[5.4-8.6]	
Language spoken at home			0.01
Spanish-born	6.7	[6.2-7.4]	
Spanish only	7.0	[6.3-7.8]	
Spanish and other language	8.8	[7.5-10.1]	
Other language only	8.8	[7.1-10.5]	

[a] The age groups were created according to tooth eruption criteria.
[b] P values derived from Poisson regression models using the number of teeth (continuous) as the offset variable

Table 3. Models for the association between generational status and dental caries experience (dft+DMFT) among 313 children living in Madrid (Spain)

Explanatory variables	Model 1[a]	Model 2[a]	Model 3[a]
	RR[b] [95% CI]	**RR[b] [95% CI]**	**RR[b] [95% CI]**
Generational status			
Spanish-born	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]
2nd generation	1.19 [1.09-1.31]***	1.18 [1.07-1.30]**	1.10 [1.00-1.22]
1st generation	1.15 [1.03-1.28]*	1.17 [1.05-1.31]**	1.18 [1.05-1.33]**
Sex			
Boys	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]
Girls	0.88 [0.81-0.96]**	0.88 [0.81-0.95]**	0.93 [0.85-1.01]
Age in years	0.99 [0.98-1.00]	0.99 [0.98-1.01]	0.99 [0.97-1.00]
Family social class			
I-II (Highest)	1.00 [Reference]		1.00 [Reference]
III-IV	1.73 [1.47-2.04]***		1.66 [1.36-2.02]***
V (Lowest)	2.03 [1.72-2.39]***		1.53 [1.26-1.85]***
Marital status			
Cohabiting	1.00 [Reference]		1.00 [Reference]
Not cohabiting	0.94 [0.85-1.03]		0.91 [0.82-1.01]
Maternal education			
University	1.00 [Reference]		1.00 [Reference]
College	1.32 [1.15-1.50]***		1.08 [0.93-1.26]
Secondary	1.63 [1.43-1.86]***		1.31 [1.12-1.54]**
Primary or less	1.58 [1.37-1.81]***		1.23 [1.05-1.45]*

[a] Model 1 was unadjusted; Model 2 was adjusted for child factors (sex and age); and Model 3 also adjusted for family factors (marital status, family social class and maternal education).
[b] Poisson regression was fitted and rate ratios (RR) reported. The number of teeth (continuous) was used as the offset variable.
*p<0.05, **p<0.01, ***p<0.001

Table 4. Models for the association of age at arrival, length of residence and language spoken at home with dental caries experience (dft+DMFT) among 313 children living in Madrid (Spain)

Indicators of acculturation	Model 1[a]	Model 2[a]	Model 3[a]
	RR[b] [95% CI]	RR[b] [95% CI]	RR[b] [95% CI]
Age at arrival			
Spanish-born	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]
2nd generation	1.19 [1.09-1.31]***	1.18 [1.01-1.30]**	1.10 [1.00-1.22]
Before age 6 years	1.28 [1.13-1.44]***	1.31 [1.15-1.49]***	1.34 [1.17-1.53]***
At age 6 years or older	0.97 [0.83-1.14]	0.99 [0.84-1.16]	0.97 [0.82-1.14]
Length of residence in Spain			
Spanish-born	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]
2nd generation	1.19 [1.09-1.31]***	1.17 [1.06-1.29]**	1.09 [0.99-1.09]
1st generation <10 years stay	1.05 [0.92-1.19]	1.07 [0.93-1.22]	1.07 [0.31-1.23]
1st generation 10+ years stay	1.29 [1.12-1.48]***	1.36 [1.17-1.58]***	1.38 [1.18-1.61]***
Language spoken at home			
Spanish-born	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]
Spanish only	1.05 [0.96-1.16]	1.05 [0.96-1.16]	1.02 [0.92-1.13]
Spanish and other language	1.34 [1.17-1.52]***	1.33 [1.16-1.52]***	1.31 [1.14-1.50]***
Other language only	1.31 [1.16-1.52]***	1.33 [1.17-1.52]***	1.25 [1.09-1.83]**

[a] Model 1 was unadjusted; Model 2 adjusted for child factors (sex and age in years); and Model 3 also adjusted for family factors (marital status, family social class and maternal education).
[b] Poisson regression was fitted and rate ratios (RR) reported. The number of teeth (in its continuous form) was used as the offset variable.
*p<0.05, **p<0.01, ***p<0.001